

SWIMMING POOLS



Concrete for Permanence

Published by
PORTLAND CEMENT ASSOCIATION

CONDENSED SPECIFICATIONS FOR CONCRETE SWIMMING POOL CONSTRUCTION

GENERAL

General Conditions

The plain and reinforced concrete work shall be governed by the contract, these specifications and the plans.

MATERIALS

Cement

The cement shall meet the requirements of the current standard specifications for portland cement of the American Society for Testing Materials.

Fine Aggregate

Fine aggregate shall consist of sand or screenings from crushed rock or pebbles, well graded from fine to coarse, passing, when dry, a screen having four (4) meshes to the linear inch. Fine aggregate shall not contain injurious amounts of vegetable or other organic matter, nor more than seven (7) per cent by volume of clay, dust or loam.

Coarse Aggregate

Coarse aggregate shall consist of hard crushed rock or pebbles, free from vegetable or other organic matter and shall be practically free from soft, flat or elongated particles. It shall be well graded from $\frac{1}{4}$ inch to 1 inch in size, not more than five (5) per cent passing a screen having four (4) meshes per linear inch.

Mixed Aggregate

Crusher-run stone, bank-run gravel or mixtures of fine and coarse aggregate prepared before delivery on the work shall not be used, unless same are tested beforehand and proportioned so as to insure obtaining a concrete of the required quality, density and strength.

Water

Water shall be clean and free from oil, acid, alkali, organic matter or other deleterious substances. It should be pure enough to drink.

Reinforcement

Reinforcing metal shall meet the requirements of the current standard specifications for steel reinforcement of the American Society for Testing Materials. It shall be free from excessive rust, scale, paint, or coatings of any character which would tend to reduce or destroy the bond. Either plain or deformed steel bars or wire mesh shall be used.

Joint Filler

The joint filler shall be an elastic water-proof material that will not become soft and run out in hot weather nor hard and brittle in cold weather.

CONSTRUCTION

Excavation

Excavation shall be made to the proper dimensions and elevations, allowing for exterior forms and line of drain tile, and for sand fill under floor if required. All refuse material encountered at grade shall be removed and all soft or spongy spots excavated and holes refilled with well tamped sand or gravel.

Subbase

After the walls have been erected and the forms removed, a four (4) inch subbase of sand shall be provided to insure a firm foundation for the floor. The sand should be wet down and well compacted by rolling and should be wet, but with no standing water, when the concrete for the floor is placed.

Note: The subbase may be omitted if pool is built in porous, sandy soil or gravel.

Drainage

A line of six (6) inch drain tile, extending completely around the pool, shall be placed around the outer, lower edge of the wall footings and also under the floor of the pool. The lowest point of the drain should be connected with another drain leading to a suitable outlet.

Plumbing

The necessary piping for filling and emptying the pool, as well as for an overflow system, should be provided and placed as required.

Measuring

The method of measuring each of the constituent materials shall be such as to insure the specified proportions in each batch. A sack of portland cement (94 pounds net) shall be considered as one cubic foot or one-fourth of a barrel.

Concrete Mixing

All concrete shall be mixed in an approved type of batch mixer (except when under special conditions the engineer otherwise permits). The ingredients of the concrete shall be mixed to the required consistency for at least one and one-half ($1\frac{1}{2}$) minutes after all materials are in the mixer before any part of the batch is discharged from the drum. The mixer

should be equipped with a water measuring device which can be locked, also with a suitable charging hopper.

Retempering

Retempering of concrete or mortar which has partially hardened, that is, remixing with or without additional materials or water, shall not be permitted.

Forms

Forms shall be smooth, substantial, unyielding and so constructed that the concrete will conform to the designed shape and dimensions.

Reinforcement

Reinforcement shall be placed in the exact location shown on the plans and wired at intersections so that it will not become disarranged during the depositing of concrete. If the bars must be spliced, not less than forty (40) times the diameter of the bar shall be allowed for the splice, and bars shall be separated at least $1\frac{1}{2}$ diameters of the larger bar. In splicing wire mesh or fabric at least four (4) inches shall be allowed for the lap. Splices should be avoided at points of maximum stress.

Proportions

The concrete should be mixed in the proportions of one (1) sack of portland cement, two (2) cubic feet of fine aggregate, and three (3) cubic feet of coarse aggregate.

Consistency

In mixing the concrete, the least amount of water should be used which it is possible to employ and still obtain a workable plastic mixture which can be worked into the forms and around the reinforcement. The proper consistency is perhaps best described as "quaky." An excess of water **must** be avoided as it seriously affects the strength and impermeability of the concrete, and any batch of concrete containing such an excess should be rejected.

Placing

The concrete shall be placed in its final position as soon as possible after mixing and must be in place within thirty (30) minutes after the water has been added to the dry materials. It should be placed in horizontal layers in the walls not more than nine inches deep in as continuous an operation as possible so as to avoid construction joints. Concrete should not be placed in water. If underground springs are encountered they should be drained to a sump outside the forms and pumped out until the concrete is above the water line. The concrete should be well spaded and if the forms are rapped with mallets while placing it will help settle the concrete in place and eliminate air bubbles and stone pockets.

Joints

The surface of the footings covered by the floor slab shall be coated with tar or asphalt to prevent a bond between footings and slab, thus allowing the floor to act independently of the footings.

Surface Finish

Immediately after the forms have been removed all projections and irregularities on the exposed surfaces shall be carefully removed and all cavities neatly filled with mortar. Enough 1:2 portland cement and sand mortar should be used to fill cavities, but no plastering should be permitted. If desired, the interior surface of the walls may be more smoothly finished by wetting and thoroughly rubbing with a concrete brick or carborundum stone to obtain a still denser surface. The top of the walls should be left gritty to prevent slipping.

General

All exposed surfaces should be finished with a smooth and neat appearance.

Protection

Exposed surfaces should be kept wet for a period of at least ten days after placing in dry, hot weather.

Temperature Below 35 Degrees F.

If at any time during the progress of the work the temperature reaches or in the opinion of the engineer may within twenty-four (24) hours drop to 35 degrees Fahrenheit, the water and aggregate should be heated and precautions taken to protect the work from freezing for at least five (5) days.

Removal of Forms

The wall forms should remain in place at least thirty-six (36) hours after the concrete has been placed or until the concrete has hardened sufficiently to be self-sustaining. When freezing weather occurs, forms and bracing should remain in place an additional time equal to the time the structure has been exposed to freezing. No outside pressure should be placed on the concrete before the removal of all forms.



This inviting pool was a gift from A. J. Moyer to his fellow townsmen of Grand Junction, Colo.

SWIMMING POOLS

TO many persons swimming is one of the most enjoyable of recreations. Indulgence in this sport is, however, often limited by lack of a natural body of water. Of late years park improvements in many cities have included outdoor concrete swimming pools, and their popularity has had much to do with the spread of the swimming pool idea, even as an adjunct to the private home grounds where the family can indulge in outdoor swimming at home.

It is not the intention in this booklet to treat of

the indoor swimming pool, which is regarded as an essential feature of the modern clubhouse, but rather to present a few fundamental principles that should be observed in locating and constructing the outdoor pool so that all of its advantages may be realized.

An examination of the illustrations in this booklet will impress one with the wide range of design that may govern in the construction of a swimming pool, and will also suggest that such a structure may be simple and therefore of moderate cost.



The people of Memphis are justly proud of this excellent pool built by the city government in one of the beautiful city parks.

FINANCING

MANY methods have been used to finance public swimming pools. Some of the larger cities have budgets to cover such construction, while some of the smaller ones have to resort to other means to pay for a public pool. After a pool is completed a small admission charge will pay for all operating costs.

Public Subscription

Many pools have been financed with funds obtained by public contributions. If donations of labor, equipment, building materials and professional services are accepted as well as cash, it enables everybody to help and minimizes the task of raising the necessary funds required to complete the pool.

Rotary clubs, Kiwanis clubs, Lions clubs, commercial clubs and American Legion posts have conducted many successful campaigns for community swimming pools. In many cases one of these organizations in a town has conducted the campaign alone while in other instances several of them have joined in promoting the campaign. A pool financed by the American Legion was opened at Avoca, Iowa, in June 1924. An excellent pool at Quincy, Ill., was financed and built by the Rotary Club of that city in the late summer of 1923 and opened in the spring of 1924. A pool built by the Commercial Club at Ritzville, Wash., was turned over to the city for public use on July 4, 1924. Several civic organizations helped in the campaign for funds to build an attractive pool at Norwalk, Ohio, in 1924.



The park commissioners of Peoria built this pool in Glen Oak Park. A small charge for use of pool pays operating expenses. No fence is required as the pool is completely enclosed by the dressing rooms

Public Funds

When public funds are available for the construction of swimming pools the problem of financing is greatly simplified. Pools in most of the larger cities are built with funds allotted to the park boards. In some cities special bonds are issued for the purpose of building public pools. In 1923 there were insufficient public funds in Elgin, Ill., to build a swimming pool. A special election was held and by a vote of 3 to 1 the people decided to issue special bonds to the amount of \$35,000 for a public swimming pool.

Membership

When sufficient public interest is aroused a pool may be financed by selling in advance season tickets or life memberships which allow holders use of the pool without charge. Current expenses are



This attractive commercial pool was built on a concrete highway at the edge of Pittsburg, Kans., by a group of local business men. Powerful flood lights on the bathhouse roof provide excellent illumination for night bathing. Refreshments are served on the tables in front of the bathhouse.

met with revenue obtained from charges to non-members using the pool.

Private Enterprise

Many pools have been built for profit by individuals or groups of local business men. When favorably located and intelligently operated such pools pay handsome returns on the investment. Reports show that the annual profits often amount to 50 per cent of the total cost of the pool.

DESIGN AND CONSTRUCTION

Selecting the Site

In selecting a site for an outdoor pool, a location should be chosen where natural drainage is good. The site should be as centrally located as real estate prices, local ordinances and other conditions permit so that it can be reached with a minimum of time and effort by the greatest number of people. The natural beauty and central location of public parks frequently offer attractive locations for municipal pools. When real estate values or other local conditions make a central location impracticable the pool should be built near a car line or on a paved road as near to the city as possible. Location is of vital importance to commercial pools.

It is highly desirable to have an ample supply of water at hand, whether it be a stream, well, or public water main to reduce the cost of large water mains required for a pool supply. For the same reason the pool should be located so that it can be drained into a stream or sewer without an excessive length of drain tile. If the soil is not porous and naturally well drained an adequate drainage system must be provided under the floor and footings so as to prevent damage by frost action.

Size and Shape of Pool

The question of size for a proposed pool is a very important one and merits considerable study in order to arrive at a proper decision. The best



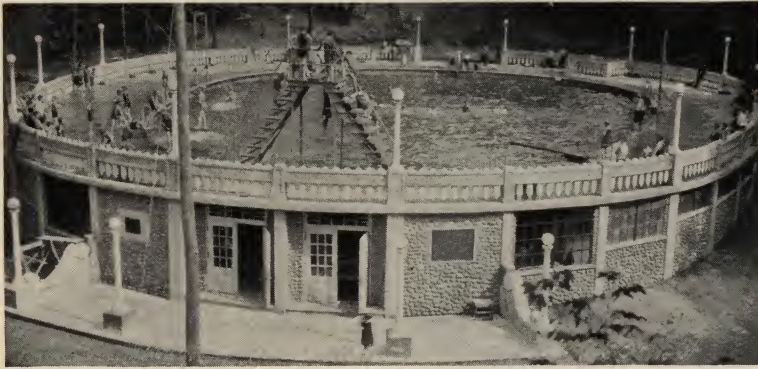
The first pool of this kind built in a public park of Joplin, Mo., created such a demand that three similar pools have been built by the park commissioners.

size of pool for any given project will be determined by the probable maximum daily attendance, by the building funds and by the site available for construction. The pool should have enough area so that it can accommodate the largest crowds which are likely to attend on holidays or special occasions, yet it should not be so large as to be wasteful of water and space during the normal season. From a commercial standpoint it is better for a pool to have the appearance of crowding than to have an apparent lack of patronage.

A very rough computation of the area required can be made by allowing a given area per bather for an estimated maximum attendance. In using



The best natural beaches are not always as satisfactory as good concrete pools. This beautiful pool in the grounds of the Saddle and Cycle Club of Chicago is only a few feet from Lake Michigan.



This pool in a park of Lansing, Mich., is almost entirely above ground. All dressing rooms, lockers, laundry and purifying equipment are below the sidewalk around the pool. The design is patented by W. Bintz of Lansing, Mich.

this method one should allow approximately 20 square feet of wading area per bather and at least 50 square feet of diving area per bather, assuming that 80 per cent of the patrons at any one time

depth, and that the remaining 25 per cent of the pool should vary from four and one-half to about nine feet deep for diving.

Rectangular pools are somewhat simpler to build than those having curved sides and for this reason pools of rectangular shape are more common than those of curved or irregular shape. The difficulty of building curved or irregular shaped pools is largely imaginary, however and their advantages sometimes more than offset any additional (real or fancied) difficulty of construction.

The circular or oval type is particularly adapted to public pools. Such a pool resembles a small lake with sides gradually sloping from the beach to a deep section in the center. The maximum shallow water space which is provided tends to reduce the overcrowding so



Brookside Pool, Cleveland, Ohio. Circular and oval shapes are very popular for large public pools because they have plenty of shallow water which prevents crowding.

will be in the area having a depth of less than four and one-half feet.

Operators of municipal and commercial pools advise that about 75 per cent of the area of the water should be four and one-half feet or less in

common in public pools due to the fact that about 75 per cent of those using them do not swim. A diving platform at the center gives open space for the swimmers, as only those who can swim are able to reach it. Furthermore, it is impossible to fall into deep water from the shore.

Principles of Design

The illustration on page 18 of this booklet suggests a design for a rectangular swimming pool. On page 19 is shown a sketch for an oval shaped pool. Complete detailed plans for either of these pools will be furnished without charge by the Portland Cement Association on request. The drawings for the rectangular pool can be used as a guide in preparing plans for pools of practically any size having vertical walls. In changing the dimensions on these plans to be used in building pools larger or smaller than the one shown, it



Several pools of triangular shape like this one at Pittsburg, Kans., have been built in Eastern Kansas and Western Missouri. This type affords a maximum area of shallow water for wading and swimming, with ample deep water for diving.

should be kept in mind that the size and spacing of reinforcement for any given section of wall is determined by the height of the wall at that section. The walls for the rectangular pool are designed to resist the inward pressure of the earth when the pool is empty and the unbalanced outward pressure of the water when the pool is full. It is assumed that they will rest on firm soil suitable for a foundation. Cracks in the concrete floor slab may be caused by temperature stresses unless the slab is properly reinforced and divided by expansion joints into sections having no dimensions greater than 60 feet. Expansion joints

important additional expense to the operation of the pool, but is seldom necessary.

Special Features

As no pool is complete without a spring board, provisions should be made for one or more at the deep end of the pool. Spring board details are shown on page 19. Chutes or slides also add much to the attraction of pools and in some pools sunshades of canvas have been found desirable.

The suggested design for a rectangular pool shows two ladders, one near the spring board and the other near the corner at the shallow end of the



Pools of irregular outline like this one in Columbus Park, Chicago, can sometimes be made to harmonize with the surrounding landscape better than those of rectangular form.

need not be provided in straight reinforced walls at intervals of less than 100 feet.

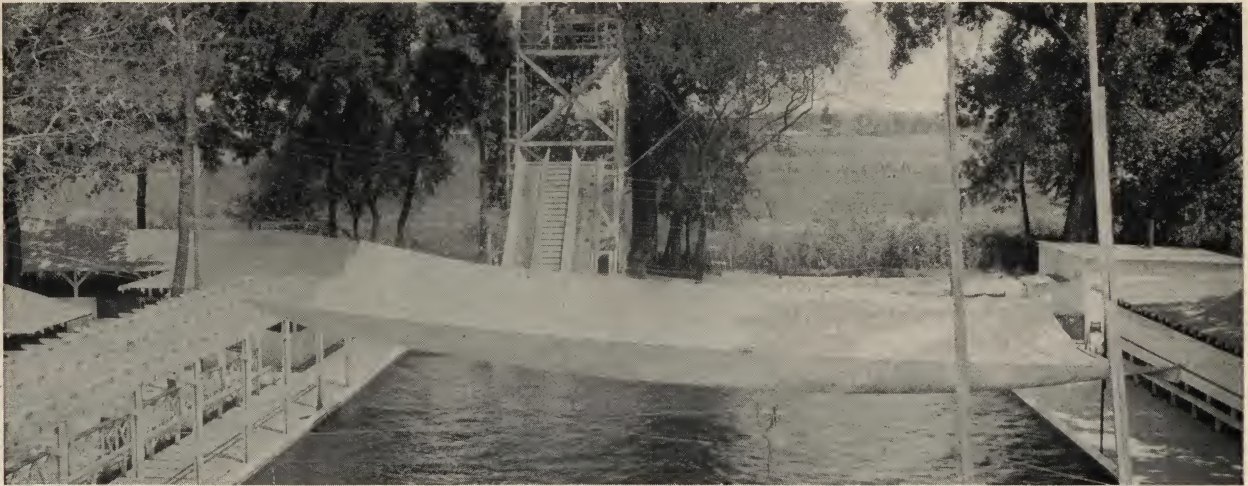
The plans for the oval shaped pool can be used as a guide in designing circular or irregularly shaped pools of any size. The floor area should be divided into sections by expansion joints so that no section would have a side more than 60 feet long.

Heating Water

The heat from the summer sun and winds is ample to warm the water in most outdoor pools sufficiently for swimming within a few hours after the pool has been filled. In exceptional cases where the filling water is extremely cold it may be desirable to heat the water as the pool is filled. In such cases the water can be warmed by passing it through a heater into the pool or by discharging steam into the water as it comes into the pool. The operation of such heating equipment is an

pool. By embedding short piping in the top of the wall and in the floor when the concrete is placed and later fastening the ladder to these, the work of installing the ladder will be made very simple. If preferred, ladder rungs may be embedded directly in the walls, or bolts may be placed to which the rungs are later fastened. Sometimes steps extending across the entire end of the pool are used. If these are built, the surface should be left gritty, as by a wooden float, or it may be washed with acid. This finish should also be given to the top of the wall to prevent slipping.

Provision must also be made for safety of swimmers by placing a hand-hold, pipe rail or rope above the water around the pool so that swimmers may hold on to this and support themselves at the surface of the water with little effort. The best arrangement is a combination hand-hold and scum gutter built into the wall at the time of construction. If a scum gutter is not provided, ringbolts



When the mercury soars in Tulsa, a cool place can be found under the sun shade of this pool in Sunset Park at the edge of town.

spaced about 10 feet apart may be embedded near the top of the wall. A galvanized pipe not less than $1\frac{1}{2}$ inches outside diameter placed through these bolts will form an excellent support or a large rope stretched tight will serve. All diving platforms, stairways to chutes and platform around the tops of chutes or slides must be protected with guard railings.

Prime essentials of a swimming pool are that it shall be watertight and easily cleaned. This can be attained with concrete which has been properly proportioned, mixed and placed. Well-made concrete is dense and impervious, hence a concrete swimming pool can readily be kept sanitary. Although no surface finish other than that secured

by carefully spading the concrete next to the face of well-made, smooth forms is necessary, other surface finishes can readily be obtained. An excellent finish can be secured by polishing the surface of the concrete with carborundum bricks immediately after the forms are removed. A number of cement paints are on the market which can also be used to give the pool nearly any desired shade of color.

The Water Supply

Unless the water supply is from a source that furnishes pure, clear water, it should be filtered before passing into the pool. Sparkling cleanliness of the water contributes much to the attractiveness and enjoyment of an outdoor pool.



The slides, stairways and platforms of this pool in Onondaga Park, Syracuse, N. Y., are well protected by guard rails.



The Missouri Country Club of Kansas City, Mo., has an attractive pool on the lawn in front of the clubhouse. Screens serve as a sunshade and keep out mosquitoes and falling leaves.

It is particularly necessary that for inexpensive operation the facilities for filling and emptying the pool be as simple as possible. The pool should be located so that gravity flow will quickly empty it when necessary to change the water.

Pool as Skating Rink

The coming of cold weather does not mean that the usefulness of the pool has ceased until the next spring. A properly designed and constructed concrete swimming pool may be allowed to freeze over in winter, thereby providing a skating rink. Many pools are allowed to freeze over in the winter until the ice becomes more than a foot thick, without injury.

Cost

The cost of a concrete swimming pool is determined by the size of the pool, by its design and by local prices of material and labor. After a tentative design has been selected, a reliable estimate of the cost of proposed pool can usually be furnished by some local engineer, architect, or contractor who is familiar with local prices of material and labor.

The items which make up the cost of the pool are: cost of the site, clearing site, excavation, materials for concrete, form lumber, reinforcement, piping, valves, accessories and labor for

building forms, placing reinforcement, mixing and placing concrete. The materials required for each cubic yard of concrete are 1.70 bbl. of cement, 0.52 cu. yd. of sand and 0.77 cu. yd. of pebbles or crushed rock, where the recommended mix of 1 part cement, 2 parts sand and 3 parts of pebbles or crushed rock is used.

With a definite plan for a pool available, it is not difficult to compute accurately the materials required and to arrive at an accurate estimate of cost if local prices of material and labor are known. The table below shows the quantities involved in the construction of three sizes of pools.

Bath Houses

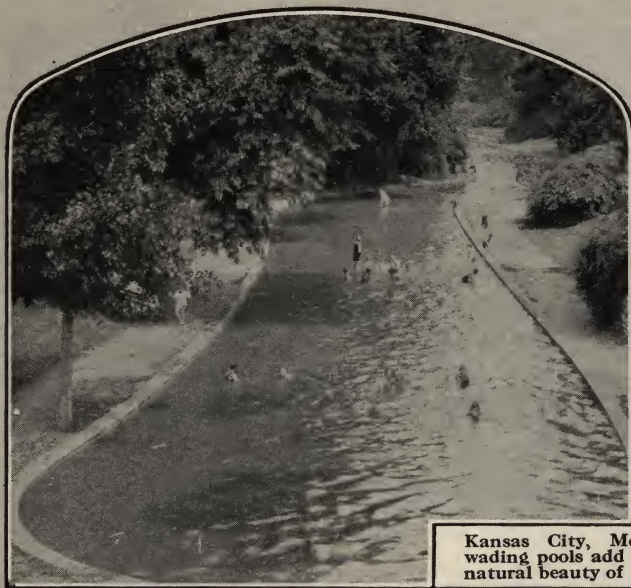
A bath house must be provided to house the offices, dressing rooms, lockers, showers, toilets, laundry, refreshment stand and any other accessories with which the pool may be equipped. A structure of this kind should be planned so as to fit in well with the architectural plan of the pool and its surroundings.

The arrangement of the bath house will depend on the shape and size of the pool and on the space and money available for construction. A popular plan for a bath house is one with the entrance, cashier's office, lobby and check room for valuables located in the center with wings on each side containing lockers, dressing rooms, toilets and showers, those for men being located on one side and those for women on the opposite side of the lobby. Where the entrance is located at the end of a pool, the wings housing the dressing rooms may extend around three sides of the pool. In such cases the showers and toilets may be located at the end opposite the entrance, thus enclosing the whole pool. In other cases the wings may extend along one side of the pool. An excellent example of such an arrangement is the bath house of the Idora Park Pool at Youngstown, Ohio.

A good arrangement of a bath house is one in which patrons reach the cashier's window just inside the entrance. After securing tickets from the cashier which cover charges for lockers and

CLASS OF WORK	QUANTITIES		
	20x60 Ft. Rectangular Pool	45x105 Ft. Rectangular Pool	163x250 Ft. Oval Pool
Excavation.....	355 cu. yd.	1,328 cu. yd.	4,610 cu. yd.
Drain tile, 8-inch size.....			200 lin. ft.
Drain tile, 6-inch size.....	180 lin. ft.	300 lin. ft.	1,423 lin. ft.
Sidewalk 4 ft. wide 5 in. thick..	731 sq. ft.	1,285 sq. ft.	2,660 sq. ft.
Curb wall 2 ft. 5 in. high, 12 in. thick.....			665 lin. ft.
Footings for walls.....	29 cu. yd.	51 cu. yd.	
Reinforced walls.....	32 cu. yd.	65 cu. yd.	
Form-area for walls.....	2,040 sq. ft.	3,456 sq. ft.	3,325 sq. ft.
Floor slab, 6 in. thick.....	1,200 sq. ft.	4,725 sq. ft.	32,320 sq. ft.
Steel reinforcement, $\frac{3}{4}$ in. and $\frac{5}{8}$ in. round bars.....	5,809 pounds	10,738 pounds	
Wire mesh reinforcement in floor 35 lb. per 100 sq. ft..	420 pounds	1,650 pounds	11,305 pounds
Add cost of cast iron pipe, valves, spring boards and accessories.			
Allow for engineering services and contractors profit.			

Concrete Pools Have Replaced the Dange



Kansas City, Mo. Concrete wading pools add much to the natural beauty of public parks.



Whittle Springs, Knoxville, Tenn. Bleachers when aquatic



This pool is one of the most popular places in Wilkes-Barre, Pa., on hot sultry days.



Many pools similar have been built in the cities of Texas in the



Few pools are more popular than the Moyer Pool of Grand Junction, Colo.

erous "Ol' Swimmin' Hole" in These Cities



or commercial pools are a source of revenue
eets are held.



Penn Valley Park Pool,
Kansas City, Mo.

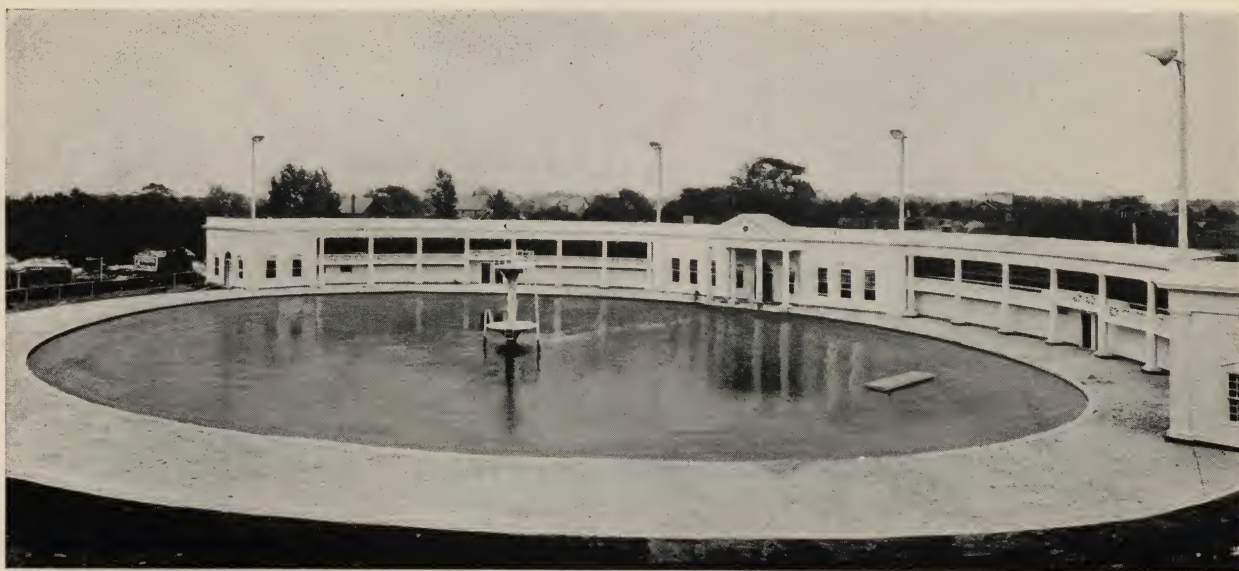


ar to this have
allas and other
the last few years.

People of Eagle Springs,
Kans., find this pool a source
of enjoyment in hot weather.



An old reservoir at McKeesport,
Pa., was converted into a popular
swimming pool.



The bathhouse in Idora Park, Youngstown, Ohio, is an example of good architecture in bathhouse design. Note the excellent arrangement of lights.

any supplies they wish in the way of suits, towels, caps, etc., they pass on to a supply counter. Here valuables may be checked and any supplies called for on the tickets obtained. After leaving the supply counter the men pass into the locker room on one side and the women into the opposite one.

The exits from the locker rooms to the pool are through shower rooms where attendants are stationed. These attendants should see that no one enters the pool without taking a shower bath and that no one apparently diseased be allowed to use the pool. The attendants would also prevent any one but bathers from entering the pool enclosure from the locker rooms. The exit from the bath house to the street should be through a turnstile so arranged that the cashier or some attendant collects the keys and any bathing supplies belonging to the establishment.

Many of the most up-to-date swimming pool operators provide electric hair dryers in the ladies dressing rooms. These are great conveniences, as it is practically impossible for women to keep their hair from getting wet when diving even with the best of rubber caps.

Dressing Rooms and Lockers

Many systems are used to care for patrons' street clothing while they are in the pool. One plan is to give each patron a large covered wire basket which he carries to any unoccupied dressing room. After putting on a bathing suit the patron puts all street clothing into the basket and turns it in at the check room where he obtains a claim check which he carries in the pool. This plan requires a minimum number of dressing rooms and no lockers but puts more responsibility on the check room attendants, and many patrons object



One of the finest pools in the country at Aurora, Ill., has clothing lockers in open courts with dressing benches between. Note the fountains delivering filtered water to the pool.

to having their clothing wrinkled in the baskets.

Another plan is to give each patron a key to an individual locker where he can hang his clothing after changing in a dressing room. Lockers can be built of lumber or excellent ones made of pressed metal can be purchased. This plan also requires a minimum number of dressing rooms and is generally more satisfactory than baskets.

Some of the best bath houses have three departments; for men, women and boys. All dressing rooms and lockers are in open courts so that they are constantly exposed to sunshine and air. The women's locker courts have lockers in double tiers with dressing rooms between, one dressing room to five lockers. The boys' locker courts have no dressing rooms but tiers of lockers with dressing benches between. The men's dressing court has



A near view of the lockers and dressing courts of the Aurora Community Swimming Pool shown on the opposite page. These lockers provide for more than 2,000 bathers at one time. Laundry in foreground.

a few dressing rooms, but the majority of men use the benches between the lockers. This is probably the most sanitary and satisfactory system of all for a public or commercial pool. A maximum number of dressing rooms are required when they are used as clothing lockers while patrons are in the pool.

The system to be used in each case must be determined by local requirements and conditions. Regardless of the system used the lockers and dressing rooms should be well ventilated to keep them from becoming musty.

Lighting

A good lighting system adds much to the attractiveness of a pool and increases its hours of usefulness. Many commercial pools find the evening hours from seven to ten more profitable than all the rest of the day.



Good hair-driers in the ladies' dressing rooms are very convenient. This type is used in the Hygienic Ice Company pool at Boulder, Colo.

A brief study of the illustrations in this booklet will give an idea of the wide variety of schemes used to illuminate pools. Incandescent lights, with and without special reflectors, flood lights and arc lights are used.

The choice of equipment will depend on the size and shape of the pool. Better results are obtained from incandescent lights when they are used with special reflectors to throw the light where it is most required. Various systems of flood lighting and arc lights are used to excellent advantage in large pools where the number of incandescent globes required would be excessive. Expert advice on lighting pools can be obtained without charge from the lighting departments of the leading electric manufacturers.

All lights should be at a sufficient height above or distance from the pool to prevent danger of their being broken as this might result in scattering glass into the pool.



Four flood lights on special towers at each end of the pool in Wing Park, Elgin, Ill., illuminate the pool brilliantly for night swimming.

SANITATION

MAINTENANCE of thoroughly sanitary conditions means much to the popularity of a swimming pool. The amount of attention necessary to keep a pool sanitary depends upon the number of bathers using it and upon the surroundings and equipment. Private pools used by few people may require little or no attention during the summer beyond occasional cleaning and refilling. An occasional bacterial test of the water is a check against pollution.

For public pools there are a number of methods which may be used to keep them sanitary. Dilution, chlorine treatment, ozonation and the ultra violet ray treatment have all been used successfully, and many pools are merely drained, washed and refilled to keep the water pure. Where dilution is depended on for purification, ample quantities of pure, warm water must be available at little cost.

Filtration

When the available water supply is not sufficient to furnish 200 gallons of water per bather it is believed that filtration and purification are imperative. Filters remove dirt and keep the water clear, but they do not remove or kill all bacteria. Chemicals or other treatments destroy bacteria but they do not remove sediment. Therefore, a filter should be used in conjunction with a bacteria destroying treatment if the same water is used continuously for several days or weeks without changing or dilution.

Pumping equipment and filters should be designed to handle and purify the entire contents of the pool in the course of one swimming day of 10 to 14 hours. There seems to be little benefit in

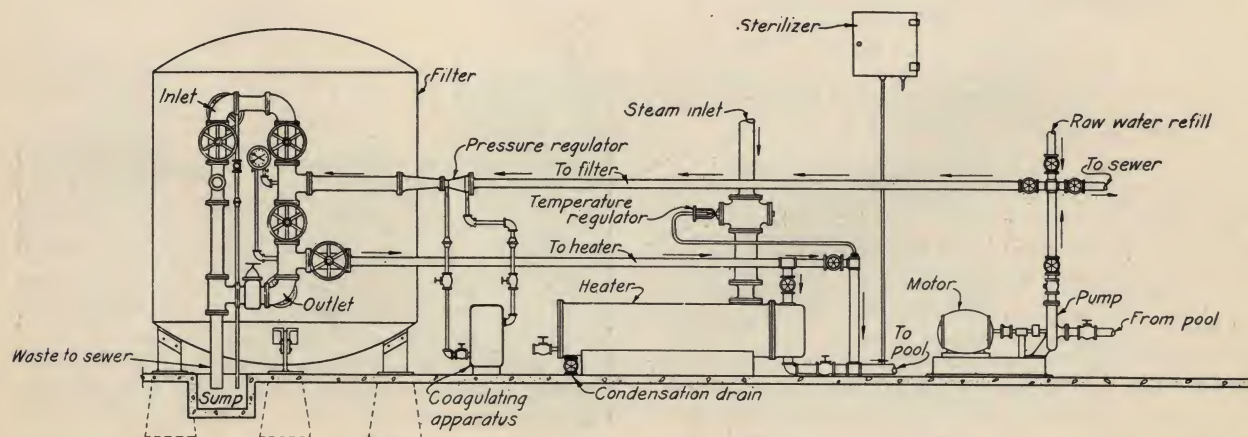
filtering or recirculating the water when the pool is not in use.

Sterilization of Water

Of the chemical methods for sterilizing the water, there are two in common and successful use. The most common of the two makes use of chlorine added to the water either in liquid form or in the form of bleaching powder mixed into a solution and fed into the supply at a rate proportionate to the flow. When bleaching powder is used, about $1\frac{1}{2}$ pounds per 100,000 gallons of water are required daily. Where pure chlorine is used about $\frac{1}{2}$ pound per 100,000 gallons of water will be sufficient. Some pools have been kept sanitary by merely adding large doses of chlorine to the water at night instead of adding it continuously. If the chlorine in the water becomes strong enough to irritate the eyes or noses of bathers the treatment should be decreased or omitted for a few days.

In the second chemical treatment, copper sulphate solution is added, either continuously or in a large dose each night after the bathers have left. A dose of $\frac{1}{2}$ lb. per 100,000 gallons of water, two or three times a week is ordinarily sufficient. Copper sulphate is also used as an algicide to prevent the accumulation of plant growth in outdoor pools. When used in this way the elevation of the water in the pool to be treated may be brought down below the line of plant growth, leaving the algae clinging to the walls. The walls are then sprayed with a 5 per cent solution of copper sulphate and scrubbed down with a wire brush. This should be done as frequently as conditions require.

Both chlorine and copper sulphate are harmless to bathers in the concentrations used in swimming pools. The taste of either is such as to discourage its use in quantities sufficient to be injurious.



A typical layout of a pressure filter. Several excellent makes are on the market.

Ultra Violet Ray Treatment

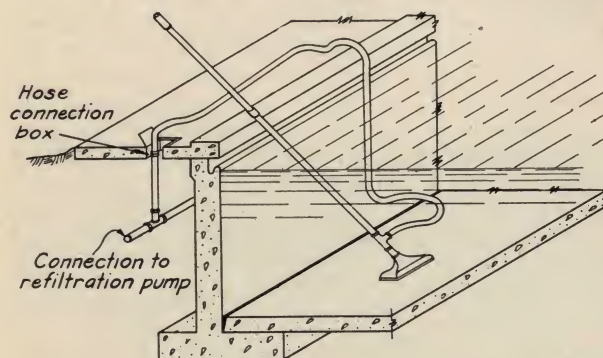
The use of the ultra violet ray treatment for purification of swimming pool water is very effective but it is more expensive to install and maintain than some other methods. An efficient filter must be provided to clarify the water and care must be exercised to prevent the accumulation of scum or sediment in the apparatus, as this renders the treatment ineffective.

Ozone Treatment

Ozone is a colorless gas containing oxygen in an active state. It may be produced by passing air through the field of a high tension electrical brush discharge. It is a powerful oxidizing agent and has strong bleaching and disinfecting powers. Because of these qualities organic substances and bacteria become oxidized on contact with ozone. It has been widely used in European cities but it has not come into general use in this country. In pools where it has been used the results have been satisfactory.

Special Precautions

The design and construction of a swimming pool should be such as to render it easy to keep the pool and its surroundings clean. A scum gutter extending all around the pool should be provided to carry away surface debris and impurities.



A suction cleaner helps to remove sediment from the bottom if used in the morning before swimmers enter the pool.

The users of the pool should be required to bathe thoroughly before entering the pool and should do their part in keeping the pool sanitary. Bathing suits should be kept clean.

A uniform procedure should be followed in caring for and testing water of public pools. Refiltration effects a considerable saving in water and heat, and keeps the water clear. Either chlorine, copper sulphate, ozone or the ultra violet ray treatments are capable of destroying bacteria and keeping the water pure.

Walks and Beaches

In planning a pool the question sometimes arises as to whether the area between the pool and the surrounding fence or bath house shall be paved, used as a sand beach or sodded over with grass. A sand beach is not recommended as bathers carry sand into the pool on their suits and feet, and in a surprisingly short time so much of it will accumulate in the pool that it will make the water cloudy regardless of the filtration system, and the removal of the sand will be an important item of expense in the course of a season.

A grass plot around the pool requires constant attention to keep it attractive. Bathers carry newly mown grass into the pool on their feet. Walking or lounging on the grass wears it out.

A concrete pavement over the area around a pool is more sanitary and in the long run is more satisfactory than either sand or grass. An adequate number of benches around the enclosure will provide comfortable places for swimmers to rest.

Safeguarding the Pool

Spring-boards should be covered with corrugated rubber mats, or other suitable material, to prevent them from becoming slippery. Sidewalks adjacent to the edges of pools should be finished with wood floats to prevent them from becoming slippery. They should drain away from the pool. Floor slabs of pools should be free from projections of material spilled during construction as such projections are likely sources of cuts or bruises. Pipes projecting into pools have caused many injuries. The depths of the pool should be painted above the scum gutter in prominent letters at intervals of 15 feet. Life-buoys should be provided in convenient places and a good lighting system contributes to safety of swimming at night.

Boys or children should not be allowed to play tag or chase each other around the pool as they are likely to fall on the walk or edge of the pool and be seriously injured. Inexperienced divers should not be allowed to dive from platforms more than 10 feet high if such are provided, and divers must be careful to avoid striking swimmers when diving from a springboard or tower.

The supervisors of swimming pools open to the public, whether they are city park officials or private individuals, are responsible for the prevention of accidents in the pools as well as for their sanitary condition. Methods for keeping pools sanitary have been outlined above. Accidents may be prevented by proper design, the enforcement of certain regulations, and supervision by capable life-guards.

WADING POOLS

The Safety of Wading Pools

Although many outdoor swimming pools, especially those which are planned with a view to public or semi-public use, are so designed as to include the possibility of being used as a wading pool also, nevertheless the depth of water at the shallow end of such pools is often greater than is safe for small children who cannot swim. Even when the shallow water is shallow enough for wading, there is always the possible danger of small children venturing too far into deep water where they are soon in trouble unless help comes quickly.

Small areas not suitable for swimming pools, can often be utilized for wading pools. School grounds, small city play grounds, or vacant lots

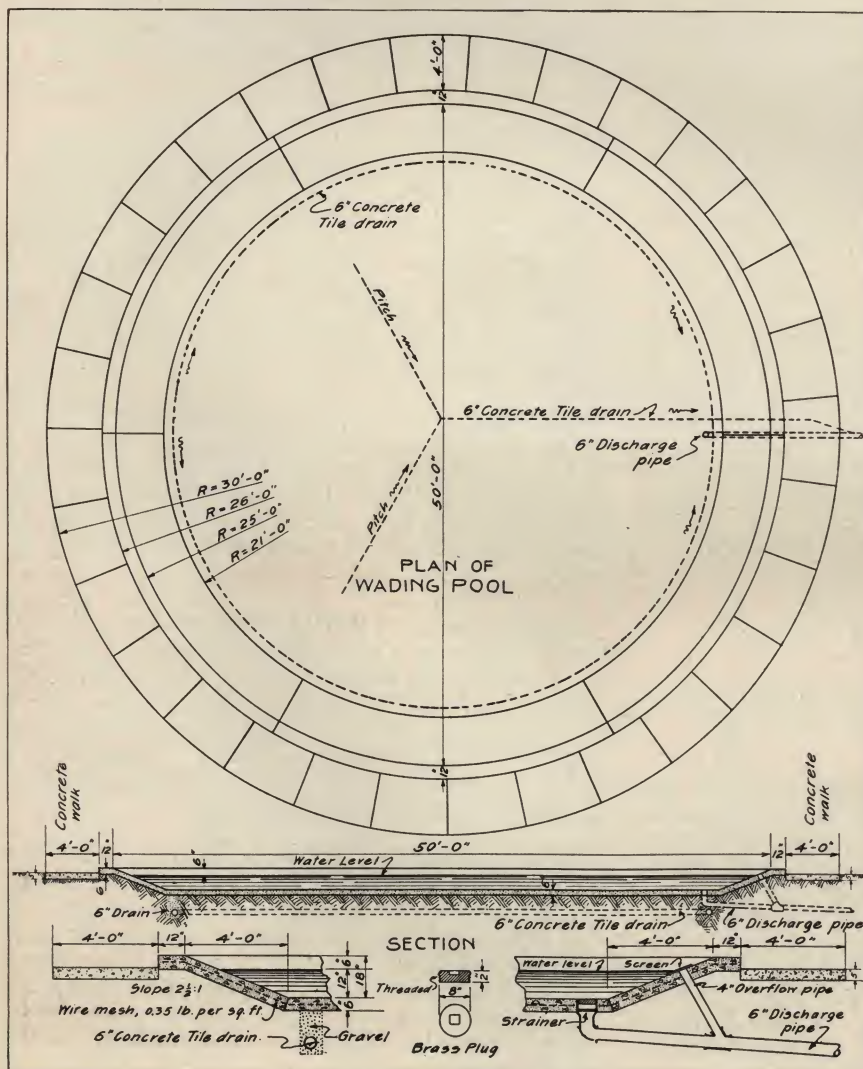


A toy sea for toy ships at Minot, N. D.

may be used, as well as public parks. Unlike swimming pools, wading pools require no bath houses which occupy valuable space, as the youngsters usually consider their play clothes as combination bathing and street suits. A large number of small pools well scattered over the city will be sources of delight to more little folks than a few large pools, because of being reached more easily. Dallas, Texas, has more than 18 wading pools in all parts of the city most of them being about 30 by 50 feet in plan, although some are considerably larger. Fort Worth also has several, and pools may be found in nearly all of the small play ground parks of Tulsa, Okla., where the future city leaders can splash about and race their miniature yachts.

A suggested design for a wading pool is shown on this page. As planned, the maximum depth of water is uniformly 12 inches. This maximum can be decreased, if desirable, by placing the outlet lower, thus lowering the water level correspondingly. This pool has an over-all diameter of 50 feet. A sloping pavement permits easy entrance to the water. The construction throughout should be of 1:2:3 concrete, mixed and otherwise handled as recommended in the construction of swimming pools. The shape and size may be changed to suit local conditions.

On account of the sloping sides of the pool



Suggested design for concrete wading pool.



Wading pool in Burnham Park, Morristown, N. J.



This wading pool is one of the most attractive features in the Municipal Playgrounds at Orange, Texas.

formed by the slabs that constitute its rim, there is little or no possibility of the pool being injured by allowing the water to freeze. For this reason the pool will form a safe skating pond during the winter months.

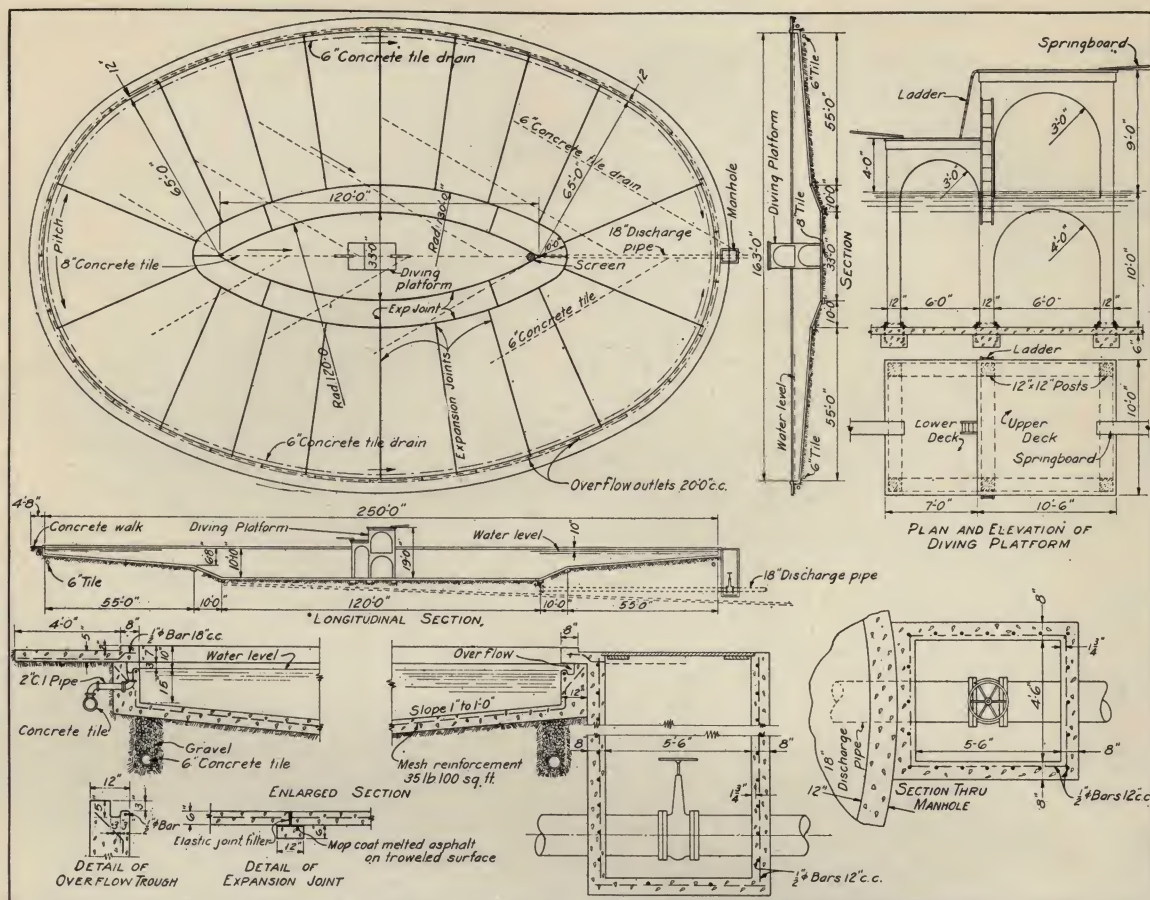
When used as a skating rink, the wading pool will afford pleasure for grown people as well as children. There are few sports which afford more exhilarating exercise and recreation. The increase in the length of the useful season for the pool gives the people who pay for it a larger personal return on their investment.

Below will be found an approximate estimate of the materials necessary to construct a wading pool of the plan and dimensions shown on Page 16.

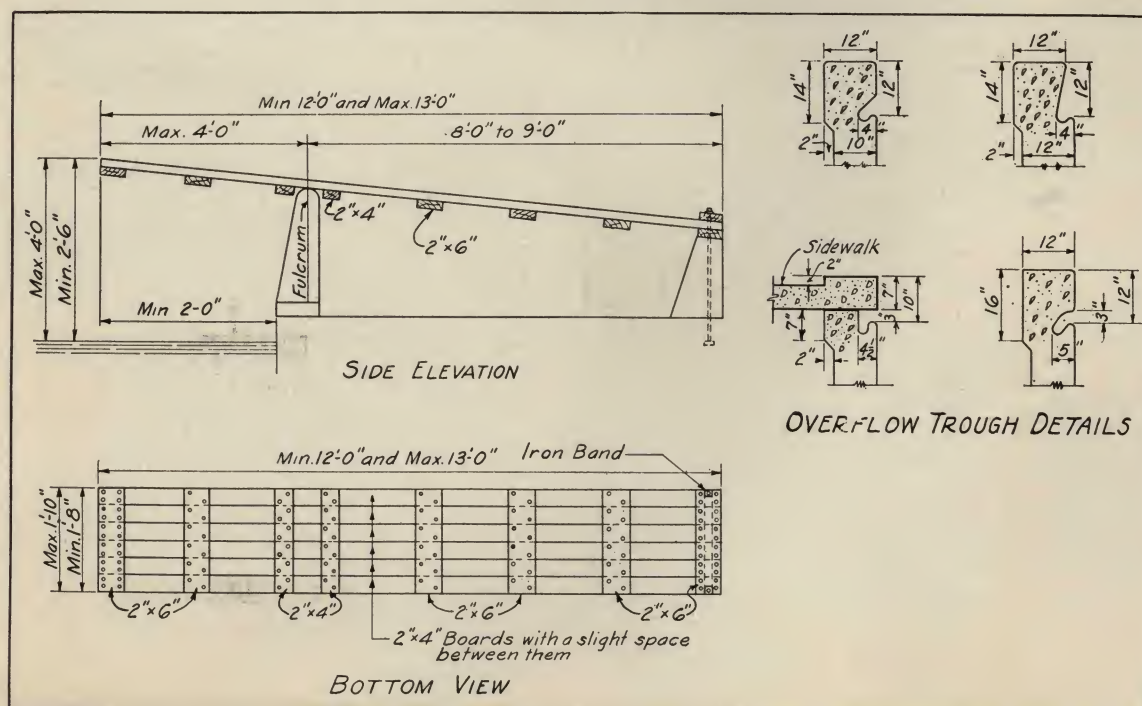
Portland cement.....	91 barrels
Sand.....	27 cubic yards
Pebbles or broken stone.....	41 cubic yards
Reinforcement.....	735 lbs. of wire fabric
	0.35 lb. per. sq. ft.
Concrete tile.....	190 feet of 6-inch



Little tots whose legs are too short to reach bottom in the shallow water of swimming pools have great times in shallow wading pools like these in Rotary Park of Oklahoma City.



Plan for an oval pool—a popular type for large municipal natatoriums.



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THE American spirit of play is exerting itself as never before. Millions of boys play football each year; many million others watch them. Countless throngs besiege golf links; as many more indulge in swimming. Thousands play and watch tennis; as many more favor baseball. All branches of sport are growing tremendously; thousands now play where hundreds played before.

Players and spectators need new and modern places of play. Whether these are tennis courts, swimming pools, grandstands, stadia, or other related structures, they must be built so that maximum service is derived from the money invested.

Durability, sanitation and economy are qualities essential to athletic improvements. *They are characteristic of well-built concrete structures.*

Make certain that these qualities are built into the structures you are planning. Get the booklets, pamphlets, and other helps offered by the Portland Cement Association. There is no charge or obligation.

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